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ON

"Impact of Agro-chemicals on Physiological Activities of Earthworm *(Pheretima posthuma)*"

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TITLE OF RESEARCH

"Impact of Agro-chemicals on Physiological Activities of Earthworm (*Pheretima posthuma).''*

Introduction

Earthworms are an important organism in the soil doing great service for mankind for millions of years now. It combines immense social, economic and environmental values together which is now being realized and recognized. A newer branch of biotechnology called 'Vermiculture Technology' is emerging by the use of earthworms to solve various environmental problem, from waste management to land (soil) improvement. Sir Charles Darwin, the great visionary biological scientist highlighted about its role in 'soil improvement and farm production' long time ago and traditional farming community was also practicing vermiculture in their farms.

Earthworms offer many benefits; increased nutrient availability, better drainage and a more stable soil structure it helps to improve soil productivity .Worms feed on plant debris (dead roots, leaves, grasses, manure) and soil.

Worms often leave their nutrient-rich casts in their tunnels, providing a favourable environment for plant root growth. The tunnel also allow roots to penetrate deeper into the soil, where they can reach extra moisture and nutrients. Extensive channeling and burrowing by earthworm loosens and aerates the soil and improves soil drainage.

Nowadays farmers use agrochemicals for increasing yield but it affects the soil health. It can kill the symbiotic bacteria's and macro -decomposers.

Unfortunately, very little attention was given to it by post-Darwin biological scientists and the modern agricultural scientists and also the farming community of world who saw agrochemicals' as a technological boon to produce more food in shorter time.

Biological and agricultural scientists all over the world, after getting utterly disappointed by modern chemical agriculture which is destroying the soil and also adversely affecting human health (the boon turning into 'bane') is now looking back into the traditional wisdom and trying to revive the dreams of Charles Darwin. Earthworms when present in soil

inevitably work as 'soil conditioner to improve its physical, chemical and biological properties and also its nutritive value for healthy plant growth. This they do by soil fragmentation and aeration, breakdown of organic matter in soil & release of nutrients, of plant growth hormones, proliferation of nitrogen-fixing bacteria. Increasing biological resistance in crop plants and all these worm activities contribute to improved crop productivity. Worm swallow large amount of soil with organise every day and digest them by enzymes. Only 3-10 percent of the digested material is absorbed into the body and the rest is excreted out in the form of fine mucus coated granular aggregates called 'Verm-castings' which are rich in NPK (nitrates, phosphates and potash), micronutrients and beneficial soil microbes (Bhat and Khambata, 1994; Bhawalkar and Bhawalkar, 1993) Value of earthworms in plant propagation was emphasized by the great Indian author Surpala in his epic Trikha-ayurveda' (Science of Tree Growing) as early as in the 10^{th} century AD. He recommended to incorporate earthworms in soil of pomogranate plants to obtain high quality fruits (Sadhale 1996) This traditional wisdom has been scientifically verified today for successful & sustainable growth of several fruits vegetables and cereal crops today without the use of agrochemicals (Singh 1993)

A greater proportion (80%) of biomass of terrestrial invertebrates is represented by earthworms which play an important role in structuring and increasing the nutrient content of the soil. Therefore, they can be suitable bioindicators of chemical contamination of the soil in terrestrial ecosystems providing an early warning of deterioration in soil quality (Culy and Berry. 1995. Soror and Larink, 2001. Bustos-Obregon and Goicochea, 2002.). This is important for protecting the health of natural environments and is of increasing interest in the context of protecting human health (Beeby 2001) as well as other terrestrial vertebrates which prey upon earthworms (Dell'Omo et al. 1999) The suitability of earthworms as bioindicator in soil toxicity is largely due to the fact that they ingest large quantity of the decomposed litter, manure, and other organic matter deposited on soil, helping to convert it into rich topsoil (Reinecke and Reinecke, 1999, Sandoval et al 2001). Moreover, studies have slawn that earthworm skin is a significant route of contaminant uptake (Lord et al. 1980,) and thus investigation of earthworm biomarkers in the ecological risk assessment (ERA) can be helpful (Sanchez-Hernandez, 2006.)

Origin of the problem

Earthworm is the standard test organism used in terrestrial ecotoxicology, because it can be easily bred on a variety of organic wastes with short generation times (ISO, 1993. 1998 OECD, 1984, 2004.) earthworm species vary in their tolerance, reports have shown a decline in earthworm populations in response to large amounts of organic chemical deposition (Bayer and Foy, 1982 Mortality has been the most frequently used parameter to evaluate the chemical toxicity in earthworms (Van Gestel and Van Dis, 1988 Van Gestel et al. 1989, and Robidoux et al. 1999). It is postulated, however, that survival is less sensitive from an ecotoxicological point of view (Robidoux et al. 1999), and acute mortality tests would not provide the most sensitive risk estimate for earthworms in the majority (95%) of cases (Frampton et al 2006. Amorim et al. (2005) tested with herbicide Phenmedipham and found reproduction to be a more sensitive endpoint than mortality in Enchytraeus albidder and Enchytraeus luxuriosus. It is suggested that the chronic test, aiming at sublethal effects, is more sensitive and is a more realistic approach for the prediction of environmental effects because in the field, the exposure concentrations of pesticides are usually quite low (Rombke et al. 2007). Moreover, the lethal effect of a chemical is not a necessary consequence in intoxication and sublethal effects may be produced. According to Riepert er al. (2009) the acute earthworm test is part of the basic test set, but the earthworm reproduction test is considered ecologically more relevant. Therefore, growth and reproduction have been recommended as useful sub lethal criteria (Paoletti 1999.,Van Gestel et al. (1992.)

Most of work has been on the biodiversity or on the mortality of the earthworms But mortality of earthworm doesn't occur at its low concentration but it affect on the physiological activity of the earthworms, Hence present work have been undertaken to study the effect of chemical formulation on the physiological activities of the earthworm.

Interdisciplinary Relevance

Such type of work can be carried out through interdisciplinary way with the department of Agriculture studies. Effect of agrochemicals on soil macro fauna can be studied by department of Environmental Science, while the effect of agrochemicals on Biochemical changes in the earthworm can be studied by department of biochemistry. Thus the work has interdisciplinary important and can be carried out interdisciplinary way.

Review of Research and Development in the subject

Sir Charles Darwin, the great visionary biological scientist highlighted about its role in soil improvement and farm production' long time ago and traditional farming community was also practicing vermiculture in their farms.

So many workers studied Diversity of Earthworms (Richards et al. 2008, Daiane 2006) in 20th century chemical formulation in large scale to increase yield caused advert effect on the soil biotic fauna including earthworm. In this regards work has been started. The influence of agro- chemicals effect of on the various physiological activities. Earthworms are considered as important bioindicators of chemical toxicity in the soll ecosystem. Studies on this aspect are important because the earthworm are the common pray of many terrestrial vertebrate species such as birds and small mammals and thus they play key role in biomagnifications process of several soil pollutants. Majority of the studies have used mortality as an end point rather than subtler end points such as reproductive output.

International Status:-

Such type of work has been done by various workers at International level, Maleki et al (1981) observed effect of metals on the growth & reproduction of earthworm. Most of the workers have worked on the effort of metals on the growth & reproduction of earthworm. Most of the workers have worked on the effect of toxic substances on the growth & reproduction such as Nechauer et al (1984), Ma and Bodt (1993), Neuhauser and Callahan. 1990,

Beyer and Foy, (1985) herbicides effect on regeneration Ma (1984) worked on Toxic effect of copper on earthworm in sandy agricultural soil. Bouch (1992) studied Ecotoxicological studies related with earthworm species: Edwords (1992) tested effects of various chemicals on earthworm & explain the advantages & limitation of field tests, Heim bach (1992) studied effects of pesticides on earthworm population & compared the results from laboratory with field tests, Paraiba et al (2003) also worked out in this similar subject Richard et al (2008) abundance of earthworm across the agricultural land use intensity gradient.

National Status:-

Lalthanzara H. and Ramanujan S.N.(2010) Effect of fertilizer (NPK) on earthworm population in the agroforestry system of Mizoram, India. Vaithiyanasthasamy Kavitha et al. (2019) worked on "Impact of pesticide monocrotophos on microbial populations and

histology of intestine in the the indian earthworm *Lampito mauritii* (kinberg).Sakshi, Dharambir Singh and Parveen Gill (2021) worked on "effects of Imidacloprid and Pendimethalin on Carbohydrates, Lipid and Protein constituents of *Pheretima posthuma*.

Shruthi N. Biradar A.P. (2017) Tested toxic effect of inorganic fertilizers to earthworm *(Endrius eugeniae*).

Regional Status:-

Chaudhari M.S. and Patil N.B. (2019) worked on effect of some fertilizers on histological and physiological aspects of earthworm.

Wakale Ajit and Kulkarni Suresh (2018) worked on effect of ampligo insecticide on caudal regeneration in earhworm.

Pawar Santosh and Shahezad Ahemad (2013) worked on impact of organophospate (chloropyriphose) on weight and growth of earthworm, *Eisenia foetida.*

Significance of the study:-

Toxicology is younger branch of biology. It has emerged to give proper shape and position in the global research in basic not only to Animal Science but even Agricultural, Environmental. Biochemical Science and Environmental engineering branches. Decrease in population and growth of animals is the big problem before every nation. In India due to population crises, we face the problem of nutritional food through our food grains is only natural source to overcome the problem.

In present status due to unscientific use of the chemical fertilizers, pesticides, herbicides, fungicides uses important beneficial invertebrates species are becoming a prone to death and vanishing speedy from their natural habitat. The species which are sustaining their lives are poor in production and growth rate. It is reported through earlier studies that on accumulation of certain agrochemicals in biological systems retards the growth and hampers the breeding behavior in earthworm species. It affects hormonal level severely and produces non-recoverable alterations in population growth and growth rate in individual species.

Objectives:-

This study will be helpful to ecological risk assessment. Earthworms are often used as test organism because of their important functions, for example decomposer and their sensitive reaction towards environmental influences Earthworms are ecologically very important because there may be a risk secondary poisoning through feeding on worms contaminated by toxic substances.

Hence the present study is an attempt for agrochemicals effect on physiological activity of earthworm.

It will also helpful to find out:-

1) To examine number and types of species found in Beed and Parbhani district.

2) To study the soil contamination and pollution status of agricultural land.

3) To examine agrochemicals on the various physiological changes and population dynamics of earthworm.

4) To observe the effect of agrochemicals on mortality of earthworms.

5) To check the toxicity of agrochemicals can on destruction of the physiological systems of an earthworm.

6) To determine the physiological changes and acute toxic test.

Hypothesis:-

Aim of the study is to determine the effect of agrochemicals on physiology and reproduction of the earthworm (Pheretima posthuma).

In the proposed investigation the agrochemicals may show significant effect on growth rate and reproduction by disturbing various physiological activities. Leading to loss of earthworm population and soil biodiversity.

Methodology:-

Earthworms will be collect using modified version of TSBF (Tropical Soil Biology and fertility) method (Anderson and Ingram, 1993; modified by Benito, 2005) and identifying various keys like Rihi, 1990. Test will conducted by using the method by OECD guidelines 1984 and Pant & Sahu, 2002. Biochemical changes will be estimate using methods Protein

(Lowry, et al., 1951), glycogen Dezwann and Zandee, (1972) and lipid Barnes and Blackstoch, 1973 Urea and uric acid by Varley (1976) and Caraway (1963).

Year wise plan of work and target to be achieved:-

First year: -Survey and selection of site, collection and identification of earthworm species and collection of literature pretending to the work.

Second year: - Carrying experiments on effect of agrochemical on various activities, and applications.

Third Year: Completion of data and preparation of final report and submission of thesis.

Expected Outcomes:-

The aim of this study is to determine the toxicity of agrochemicals and its effect on physiology of earthworms. The fertilizers and insecticides in high concentration will affect the reproduction and population rate of the earthworms. This study will help to provide information for agroecosystem. The outcome of this research is to reduce use of agrochemicals which will help to increase earhworm population which enhances the quality of soil.

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